

REMARKS

Favorable consideration of the present application is respectfully requested.

Claims 2-3 have been cancelled and Claim 1 has been amended to recite the features of the cancelled claims that the average distance between adjacent intermetallic compound particles in the joined portion is 60% to 130% of the average distance between adjacent intermetallic compound particles in a non-joined portion, and the average of the grain diameter of metallic crystals in the joined portion is 20% to 500% of the average of the grain diameter of metallic crystals in a non-joined portion. Dependent Claims 7-10, 11, 12, 13, 15 and 16 have also been cancelled herein.

The claimed invention is directed to a sputtering target prepared by the butt joining of metal sheets made of the same material, characterized by a joined portion produced by friction stir welding (FSW). Sputtering targets have unique requirements. For example, they are not load bearing and so strength is not an issue. On the other hand, it is important that a sputtering target has a uniform composition in order to minimize the occurrence of arcing, and in order to provide a uniform sputtering rate and layer characteristics. In the conventional technique of welding two metal sheets by FSW to provide a large size sputtering target, the structure of the crystal grains at the joined portion has been coarsened compared with the non-molten portion, thereby causing a poor appearance and the aforementioned operational defects.

Because the claimed invention is a sputtering target, the joined portion of the butt joined metal sheets must not have an excessive or insufficient presence of an intermetallic compound, in order to minimize variations in the thickness of the film produced by the sputtering. Claim 1 therefore recites that the intermetallic compound in the joined portion has an average particle diameter of 60% to 130% of the average particle diameter of the intermetallic compound in a non-joined portion, and that an average distance between

adjacent intermetallic compound particles in the joined portion is 60% to 130% of the average distance between adjacent intermetallic compound particles in the non-joined portion, (pp. 9-10). Also, in order to minimize variations in the thickness of the film produced by the sputtering due to coarsening of the metallic crystal grains (p. 11), the average grain diameter of metallic crystals in the joined portion is 20% to 500% of the average of the grain diameter of metallic crystals in a non-joined portion, and this is now also recited in Claim 1. Similarly, dendric structure in the joined portion should be avoided (Claim 4). In each case, these characteristics of the joined portion can be achieved by FSW. Also, in each case post FSW annealing reverses changed crystal orientation in a sputtering target due to plastic flow resulting from the FSW.

Claims 1-6 and 12-17 have been rejected under 35 U.S.C. § 103 as being obvious over Rhodes et al in view of the publication to Pao et al. This rejection is respectfully traversed.

Rhodes et al discloses that FSW has been known, but not for preparing a sputtering target. Nonetheless, the Office Action considered the use of FSW for the preparation of sputtering targets to have been obvious, i.e., the product of Rhodes et al could be used as a sputtering target. However, since the product of Rhodes et al must be modified by Pao et al, the relevant question is whether the modification of a sputtering target having a joined portion produced by FSW in view of Rhodes et al, to provide post FSW annealing, would have been obvious to one skilled in the art.

Applicants recognize that according to *KSR Int'l Co. v. Teleflex Inc.*, 127 S.Ct. 1727 (2007), “[i]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.” More particularly, a “combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.” *Id.* at 1739. Thus, applying

FSW to the preparation of a sputtering target, and particularly applying post FSW annealing, would have been unobvious if it does not improve the preparation of the sputtering target “in the same way” as other known uses, i.e., if it provides unpredictable results for sputtering targets.

It is respectfully submitted that evidence of such unexpected results are present in this case. The conventional concern, as expressed in Rhodes et al, is the effect of changes in microstructure due to FWS on the mechanical (tensile strength) properties of the workpieces (p. 69, last 7 lines). Therefore, benefits in the uniformity of layer production, as would arise in the fabrication of a sputtering target, would not have been expected in view of Rhodes et al – this would have been an unpredictable result.

This is confirmed in the citation of Pao et al, which was cited to disclose post FSW annealing. Pao et al teaches that the post FSW annealing has the benefit of restoring the strength of the weld region (p. 607). It thus confirms that strength – not uniformity in sputtering – is the known or predictable result to be conveyed by both FSW and post FSW annealing.

Thus providing FSW with post FSW annealing in a sputtering target would not have been obvious to one skilled in the art, despite the fact that both were known, *per se*, because the provide unpredictable results, i.e., they do not improve sputtering targets “in the same way” as for other products. Strength is not a concern in sputtering targets; the concern there is uniform sputtering for creating uniform sputtered layer characteristics. The prior art teaches providing FSW with post FSW annealing for strength, and so uniformity of sputtering for uniform sputtered layer characteristics is an unpredictable improved result. Accordingly, under the standard set forth in *KSR Int'l Co. v. Teleflex Inc.*, it would not have been obvious in view of Rhodes et al and Pao et al to have used FSW in a sputtering target and provided post FSW annealing.

Applicants therefore believe that the present application is in a condition for allowance and respectfully solicit an early Notice of Allowability.

Respectfully submitted,

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